

App. No. 10/715,322
January 9, 2006 Amendment and
Reply to Office Communication mailed December 21, 2005

Docket No. QNX003

IN THE CLAIMS:

Claims 1-11 are canceled.

Claim 12 as amended in Applicant's First Amendment is cancelled. Original claim 12 is now re-instated and now appears as it did when it was originally submitted with a minor amendment to correct a typographical error.

Claims 13-15 are re-instated in their original form as so noted below.

Claims 16-18 have been cancelled.

Claims 19-32, previously presented, are canceled.

Claims 33-45 have been added.

1-11 (Canceled).

12. (Currently amended) A liquid cooling system comprising:

a heat transfer unit operating under the peltier effect, the heat transfer unit including a cold region and a hot region generating heat, wherein the cold region is capable of mating with a processor;

a conduit coupled to the hot region and dissipating heat by transporting cooled liquid, the cooled liquid transforming into heated liquid in response to receiving the heat from the hot region; and

a heat exchange unit coupled to the conduit and receiving the heated liquid, the heat exchange liquid unit generating the cooled liquid in response to receiving the heated liquid.

13. (Original) A liquid cooling system as set forth in claim 12, wherein the heat transfer unit comprises a first heat conducting material operating under the peltier effect and including a first hot region and a first cold region, a second heat conducting material operating under the peltier effect and including a second hot region and a second cold region, wherein the first hot region and the second hot region form the hot region and the first cold region and the second cold region form the cold region.

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14. (Original) A liquid cooling system as set forth in claim 13, wherein the first conducting material and the second heat conducting material are coupled at a junction.

15. (Original) A liquid cooling system as set forth in claim 14, wherein the first heat conducting material and the second heat conducting material form a junction for mating with the processor.

16-32 (Canceled)

33. (New) The cooling system of claim 13 wherein the first cold region and the second cold region are disposed in close proximity to each other and both are thermally coupled to one or more heat-generating components such as a processor and wherein the first hot region and the second hot region are both thermally coupled to the conduit, the cold regions absorbing heat from the heat-generating components and transferring such heat to the hot regions.

34. (New) The cooling system of claim 13 wherein the first hot region and the second hot region are disposed in close proximity to each other and both are thermally coupled to the conduit and wherein the first cold region and the second cold region are both thermally coupled to one or more heat-generating components such as a processor, the cold regions absorbing heat from the heat generating components and transferring such heat to the hot regions.

35. (New) The cooling system of claim 12 wherein the heat transfer unit further comprises:
an inlet coupled to the conduit for receiving the cooled liquid from the heat exchange unit and thermally coupling the cooled liquid to the hot region;
an outlet of the heat transfer unit coupled to the conduit for receiving heated liquid from the conduit coupled to the hot region and directing the heated liquid to the heat exchange unit; and
wherein the inlet is disposed below the outlet for enhancing convective flow of the liquid.

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36. (New) The liquid cooling system as set forth in claim 13 having N heat transfer units as described in claim 13 interleaved with and in close proximity to N, N-1 or N+1 heat generating components wherein heat from each such component is absorbed by the cold regions of the first and second heat conducting materials of all heat transfer units interleaved with such component and wherein N is an integer greater than 1.

37. (New) The cooling system as set forth in claim 36 wherein one or more of the N heat transfer units further comprises:

an inlet coupled to the conduit for receiving cooled liquid from the heat exchange unit and coupling the cooled liquid to the first and second hot regions;

an outlet coupled to the conduit for receiving heated liquid from the first and second hot regions means and directing the heated liquid to the heat exchange unit; and

wherein the inlet is disposed below the outlet for enhancing convective flow of the liquid.

38. (New) The cooling system of claim 12 wherein the cold region and the hot region are part of an electron conducting material coupled to a power source.

39. (New) The cooling system of claim 38 wherein the electron conducting material is embedded in the substrate of a semiconductor material.

40. (New) The cooling system of claim 38 wherein the electron conducting material is a solid state, peltier-effect device.

41. (New) An electronic system having the cooling system as set forth in claim 12.

42. (New) A mobile electronic system having the liquid cooling system as set forth in claim 12.

43. (New) A portable electronic system having the liquid cooling system as set forth in claim 12.

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44.(New) A system with optical devices having the liquid cooling system as set forth in claim 12.

45. (New) A method for cooling heat generating components in an electronic system having a heat transfer unit operating under the peltier effect, the heat transfer unit including a cold region and a hot region generating heat, wherein the cold region is capable of mating with one or more heat-generating components and having a conduit for transporting liquid coupled to the hot region and coupled to a heat exchange unit; the method comprising the steps of:

transferring heat from the heat-generating components to the cold region;

transferring heat from the cold region to the hot region;

absorbing heat from the hot region into the liquid thereby heating the liquid;

transporting the heated liquid to the heat exchange unit;

cooling the heated liquid in the heat exchange liquid by dissipating heat from the liquid;

and

transporting the cooled liquid from the heat exchange unit through the conduit to the coupling with the hot region.